

NASA Facts

National Aeronautics and Space Administration
Goddard Space Flight Center
Greenbelt, MD 20771
(301) 286-8955



November 1996

Space Experiment Module Program (SEM)

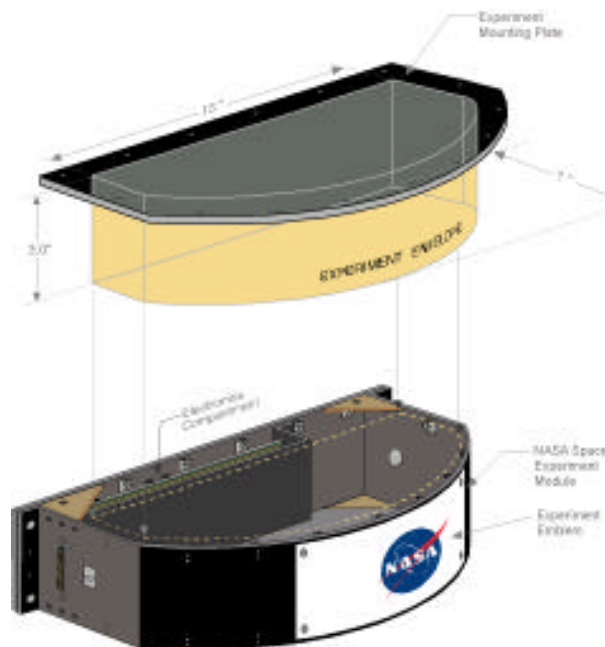
The Space Experiment Module (SEM) Program is an education initiative sponsored by the National Aeronautics and Space Administration (NASA) Shuttle Small Payloads Project. The program provides nationwide educational access to space for Kindergarten through University level students. Within the program, NASA provides small containers or modules to students to fly zerogravity and microgravity experiments on the Space Shuttle. The experiments are created, designed, built, and implemented by students with teacher and/or mentor guidance. Student experiment modules are flown in a "carrier" which resides in the cargo bay of the Space Shuttle. The carrier supplies power to, and the means to control and collect data from each experiment.

Overview

The Space Experiment Module (SEM) Carrier System is a self contained assembly of engineered subsystems which function together to provide structural support, power, experiment command and data storage capabilities for zero-gravity and microgravity experiments to be flown in the NASA Space Shuttle.

Students may design experiments "on paper" using NASA supplied software and databases. Use of the software is not restricted and can be accessed through the World Wide Web [filename semxx.zip (xx is the version number) at the File Transfer Protocol site on sspp.gsfc.nasa.gov]. The software application helps the experimenter describe the experiment; enter power consumption, parts, materials, and timeline; control; and command data. The software may be used to analyze the data for SEM compatibility and "postflight" reports.

The small, enclosed module (pictured right) can contain approximately 300 cubic inches (4.9 L) of experimenter apparatus weighing up to 6 lb. (2.7 Kg.). Experiments may be active (uses carrier supplied power) or passive (non-powered). They may be contained inside of the modules by one of two methods. The first method of experiment containment uses NASA-provided "Space Capsules" to enclose passive test articles. The Space Capsules are clear, sealable polycarbonate vials 1.0 inch in diameter and 3.0 inches in depth. The second method of experiment containment utilizes the Module Cover as an Experiment Mounting Plate. The free space available for experiment apparatus in the Module experiment compartment is the "Experiment Envelope". It is a precisely defined volume delineated on the inboard surface of the Experiment Mounting Plate and extends 3.25 inches below the inboard surface of the Mounting Plate.



Individual SEM Module

The modules are powered by one 12 Volt battery independent of the Shuttle's power supply. Each module has an integrated programmable control circuit board or Module Electronics Unit (MEU) for data sampling and storage. The MEU processes the student-devised flight operations timeline. After installation of the experimenter's equipment, up to 10 modules are housed in a pressurized canister (identical to a Hitchhiker or Get Away Special canister).

During the early stage of the Shuttle flight, astronauts activate the SEM canister via the Payload and General Support Computer. For active experiments (those using battery power), the MEU's carry out their unique programmed timeline throughout the flight.

Following Shuttle spaceflight of the SEM payload, the experiment hardware, the inflight measurement data from the MEU, and a "Certificate of Spaceflight" will be returned to the student experimenters. Experimenters are requested to provide a copy to NASA of their postflight data analysis and reports. NASA archives the results and has them available for future experimenters to reference.

SEM's First Flight

STS-80 will sponsor the first SEM flight. The experimenters venturing on the first flight include:

- The Charleston, So. C school district (CAN-DO) experiments include gravity and acceleration readings, bacteria-agar research instrument, crystal research in space, magnetic attraction viewed in space, and numerous passive items such as algae, bones, yeast, and photographic film.
- Purdue University in West Lafayette, Ind., is sponsoring a number of experiments: fluid thermal convection, NADH oxidase absorbance in shrimp, and a passive particle detector experiment, and zero-gravity affects on seeds.
- Hampton Elementary School in Lutherville, Md., is experimenting with seeds, soil, chalk, crayon, calcite, Silly Putty, bubble solution, popcorn, mosquito eggs, and other organic compounds.
- Glenbrook North High School in Northbrook, Ill. is flying a surface tension experiment.
- Albion Jr. High in Strongsville, Ohio is experimenting with heat transfer and will study the heating properties of copper tubes and pennies.
- Poquoson Middle School in Poquoson, Va. is conducting a bacteria inoculation in space experiment.
- NORSTAR (Norfolk Public Schools Science and Technology Advanced Research) in Norfolk, Va. is studying the behavior of immiscible fluids.

Getting Started

There are four levels of student participation in the SEM program: the design phase, the hardware phase, the flight phase, and the postflight phase. Participation in the hardware, flight, and postflight phases is conditional, and is based on specific selection criteria. Information about ongoing SEM activities can be accessed by means of the World Wide Web or File Transfer Protocol at the addresses listed below. The software and associated documentation may be widely distributed, allowing any number of participants in the design phase.

Experiments are selected to participate in the SEM hardware phase based on the design created in the design phase (the "on-paper" design mentioned earlier), and adherence to safety standards. Participants selected for the hardware phase will receive a package of hardware from NASA to support the construction and development of the selected experiment. The contents of the package depends on the proposed experiment design.

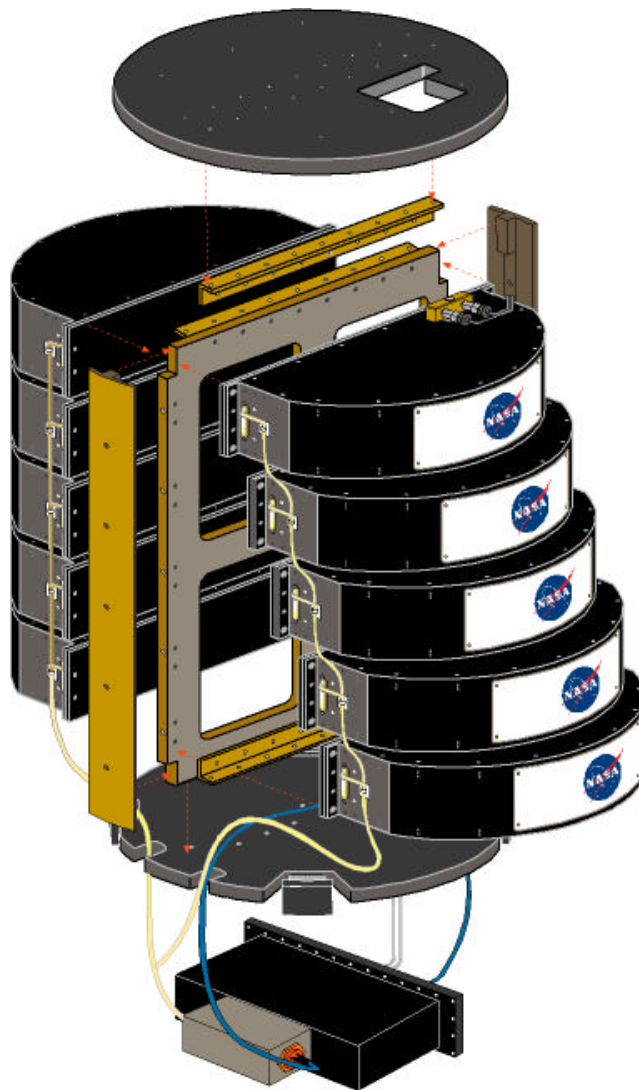
World Wide Web Address

sspp.gsfc.nasa.gov/sem.html

File Transfer Protocol

sspp.gsfc.nasa.gov/pub/software

software file name: semxx.zip (xx is the version number)



SEM Modules Installed into a Canister

Additional Information

Applications for participation in the SEM program are accepted on a continuous basis. For additional information or questions, please contact the following persons:

Mr. T. Goldsmith
Phone: (310) 286-8799
FAX: (301) 286-1694
tcg@sspp.gsfc.nasa.gov

Dr. R. Lewis
Phone: (301) 286-0818
FAX: (301) 286-1694
ruthan_lewis@gsfc.nasa.gov

For written correspondence, send your requests to:
Code 740
Shuttle Small Payloads Project
Goddard Space Flight Center
Greenbelt, MD 20771